

- c) definition of the differences between pressurization and artificial ventilation types of protection;
- d) removal of protection of rooms with an inert gas or a flammable gas from the scope of this document;
- e) addition of an informative annex to include examples of applications where types of protection pressurization or artificial ventilation or pressurization and artificial ventilation can be used and associated guidelines.

The text of this document is based on the following documents:

FDIS	Report on voting
31/1309/FDIS	31/1317/RVD

Full information on the voting for the approval of this document can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This document is to be used in conjunction with the principles of hazardous area classification from IEC 60079-10-1 and artificial ventilation for the protection of analyser(s) houses from IEC 60079-16.

A list of all parts in the IEC 60079 series, published under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## INTRODUCTION

This part of IEC 60079 gives requirements for the design, construction, assessment, verification and marking of rooms used to protect internal equipment by pressurization or artificial ventilation or both as applicable when located in an explosive gas atmosphere or combustible dust atmosphere hazardous area with or without an internal source of a flammable gas or vapour. It also includes a room located in a non-hazardous area that has an internal source of release of a flammable gas or vapour.

This document deals with rooms that are partially constructed in a manufacturer's facility and intended to have the final installation completed on-site, as well as rooms that are constructed completely on-site. Rooms partially constructed in a manufacturer's facility may include third-party verification. For rooms built on-site, this document can be used by plant operators as a guide for assessment of those facilities.

This document represents a major technical revision of the requirements for equipment protection by pressurized room "p" and artificially ventilated room "v" and should be considered as introducing all new requirements.

## EXPLOSIVE ATMOSPHERES –

### Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"

#### 1 Scope

This part of IEC 60079 gives requirements for the design, construction, assessment, verification and marking of rooms used to protect internal equipment:

- located in a Zone 1 or Zone 2 or Zone 21 or Zone 22 explosive atmosphere (an area normally requiring an equipment protection level (EPL) Gb, Gc, Db or Dc) without an internal source of gas/vapour release and protected by pressurization;
- located in a Zone 2 explosive atmosphere (an area normally requiring EPL Gc) with or without an internal source of gas/vapour release and protected by artificial ventilation;
- located in a non-hazardous area, containing an internal source of gas/vapour release and protected by artificial ventilation;
- located in a Zone 1 or Zone 2 or Zone 21 or Zone 22 explosive atmosphere (an area normally requiring EPL Gb, Gc, Db or Dc), containing an internal source of gas/vapour release and protected by both pressurization and artificial ventilation.

The term "room" used in this document includes single rooms, multiple rooms, a complete building or a room contained within a building. A room is intended to facilitate the entry of personnel and includes inlet and outlet ducts. An acoustic hood and other like enclosures designed to permit the entry of personnel can be considered as a room.

This document also includes requirements related safety devices and controls necessary to ensure that artificial ventilation, purging and pressurization is established and maintained.

A room assembled or constructed on site, can be either on land or off-shore. The room is primarily intended for installation by an end-user but could be constructed and assessed at a manufacturer's facility, where the final construction such as ducting can be completed on site.

Rooms can be located in an explosive gas atmosphere requiring EPL Gb or Gc, or a combustible dust atmosphere requiring EPL Db, or Dc.

This document does not specify the methods that may be required to ensure adequate air quality for personnel with regard to toxicity and temperature within the room. National or other regulations and requirements may exist to ensure the safety of personnel in this regard.

Protection of rooms by using an inert gas or a flammable gas is outside of the scope of this document. It is recognized that such applications are special cases, which in part may be addressed using the principles from IEC 60079-2, but in all probability will also be the subject of additional, stringent engineering standards, procedures and practices. Pressurized enclosures for equipment that are not intended to facilitate the entry of personnel are addressed in IEC 60079-2, and are not in the scope of this document.

NOTE Maintenance recommendations are contained in Annex A until they can be included in IEC 60079-17.

This document supplements and modifies the general requirements of IEC 60079-0, except exclusions as indicated in Table 1. Where a requirement of this document conflicts with a requirement of IEC 60079-0, the requirement of this document takes precedence.

**Table 1 – Exclusion of specific clauses or subclauses of IEC 60079-0**

Clause of IEC 60079-0		IEC 60079-0 application to IEC 60079-13
Ed. 6.0 (2011) (Informative)	Clause / subclause title (Normative)	
4	Equipment grouping	Applies
4.1	Group I	Excluded
4.2	Group II	Applies
4.3	Group III	Applies
4.4	Equipment for a particular explosive atmosphere	Applies
5.1	Environmental influences	Applies
5.1.1	Ambient temperature	Applies
5.1.2	External source of heating or cooling	Applies
5.2	Service temperature	Applies
5.3.1	Determination of maximum surface temperature	Applies
5.3.2.1	Group I electrical equipment	Excluded
5.3.2.2	Group II electrical equipment	Applies
5.3.2.3	Group III electrical equipment	Applies
5.3.3	Small component temperature for Group I and Group II electrical equipment	Excluded
6.1	General	Applies
6.2	Mechanical strength	Excluded
6.3	Opening times	Excluded
6.4	Circulating currents	Excluded
6.5	Gasket retention	Excluded
6.6	Electromagnetic and ultrasonic radiating equipment	Applies
7.1	General	Excluded
7.2	Thermal endurance	Excluded
7.3	Resistance to light	Modified
7.4	Electrostatic charges on external non-metallic materials	Excluded
7.5	Accessible metal parts	Excluded
8	Metallic enclosures and metallic parts of enclosures	Excluded
9	Fasteners	Excluded
10	Interlocking devices	Excluded
11	Bushings	Excluded
12	Materials used for cementing	Excluded
13	Ex components	Excluded
14	Connection facilities and termination compartments	Excluded
15	Connection facilities for earthing and bonding conductors	Excluded
16	Entries into enclosures	Excluded
17	Supplementary requirements for rotating electrical machines	Excluded
18	Supplementary requirements for switchgear	Excluded
19	Supplementary requirements for fuses	Excluded
20	Supplementary requirements for plugs and sockets	Excluded
21	Supplementary requirements for luminaires	Excluded
22	Supplementary requirements for caplights and handlights	Excluded
23	Equipment incorporating cells and batteries	Excluded
24	Documentation	Applies
25	Compliance of prototype or sample with documents	Applies
26.1	General	Applies
26.2	Test configuration	Applies
26.3	Tests in explosive test mixtures	Excluded

Clause of IEC 60079-0		IEC 60079-0 application to IEC 60079-13
Ed. 6.0 (2011) (Informative)	Clause / subclause title (Normative)	
26.4	Tests of enclosures	Excluded
26.5	Thermal tests	Excluded
26.6	Torque test for bushings	Excluded
26.7	Non-metallic enclosures or non-metallic parts of enclosures	Excluded
26.8	Thermal endurance to heat	Excluded
26.9	Thermal endurance to cold	Excluded
26.10	Resistance to light	Applies
26.11	Resistance to chemical agents for Group I electrical equipment	Excluded
26.12	Earth continuity	Excluded
26.13	Surface resistance test of parts of enclosures of non-metallic materials	Excluded
26.14	Measurement of capacitance	Excluded
26.15	Verification of ratings of ventilating fans	Excluded
26.16	Alternative qualification of elastomeric sealing O-rings	Excluded
27	Routine tests	Applies
28	Manufacturers responsibility	Applies
29.1	Applicability	Applies
29.2	Location	Modified
29.3	General	Modified
29.4	Ex marking for explosive gas atmospheres	Modified
29.5	Ex marking for explosive dust atmospheres	Applies
29.6	Combined types of protection	Applies
29.7	Multiple types of protection	Excluded
29.8	Ga using two independent Gb types of protection	Excluded
29.9	Ex components	Excluded
29.10	Small equipment and small Ex components	Excluded
29.11	Extremely small equipment and extremely small Ex components	Modified
29.12	Warning markings	Applies
29.13	Alternate marking of equipment protection levels (EPLs)	Excluded
29.14	Cells and batteries	Applies
30	Instructions	Modified
Annex A	Supplementary requirements for Ex cable glands	Excluded
Annex B	Requirements for Ex components	Excluded
Annex C	Example of rig for resistance to impact test	Excluded
Annex D	Introduction to an alternative risk assessment method encompassing "equipment protection levels" for Ex equipment	Applies
<p>Applies: this requirement of IEC 60079-0 is applied without change.</p> <p>Excluded: this requirement of IEC 60079-0 does not apply.</p> <p>Modified: this requirement of IEC 60079-0 is modified as detailed in this document.</p> <p>NOTE The applicable requirements of IEC 60079-0 are identified by the clause title which is normative. This table was written against the specific requirements of IEC 60079-0, Ed 6.0.</p>		

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition

cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-426, *International Electrotechnical Vocabulary – Part 426: Equipment for explosive atmospheres*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-29 (all parts), *Explosive atmospheres – Gas detectors*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-426, IEC 60079-0 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Unless otherwise specified, the terms "voltage" and "current" mean the RMS values of an alternating, direct or composite voltage or current.

#### 3.1

##### **airlock**

means of egress, consisting of two interdependent doors designed to maintain the internal pressure of the room in order to prevent or significantly reduce the entry of a surrounding explosive atmosphere

#### 3.2

##### **alarm**

piece of apparatus that generates a visual or audible signal that is intended to attract attention

[SOURCE: IEC 60050-426:2008, 426-09-05]

#### 3.3

##### **clean air**

air that is essentially free of combustible dust, and contains no more than trace amounts of flammable vapour or gas

#### 3.4

##### **dilution**

mixing of flammable vapour or gas with air which, over time, will reduce the flammable concentration

Note 1 to entry: For safety reasons, dilution to a level lower than the lower explosive limit (LEL) can be required if associated with the potential release there is an additional toxic or asphyxiant risk. Further guidance can be found in IEC 61285.

[SOURCE: IEC 60079-10-1:2015, 3.5.2, modified – The note to entry has been added.]

### **3.5**

#### **internal source of release**

point or location indoors from which a gas, vapour, mist or liquid may be released into the atmosphere such that an explosive gas atmosphere could be formed

### **3.6**

#### **limiting value**

lowest concentration value of the lower flammable limit (LFL) of each component involved, taking account of the most onerous conditions of concentration that may occur from every internal source of release within the room

### **3.7**

#### **lower flammable limit**

##### **LFL**

volume fraction of flammable gas or vapour in air below which an explosive gas atmosphere will not form, expressed as a percentage

Note 1 to entry: Although the lower explosive limit (LEL) is often used in place of the lower flammable limit (LFL), it should be recognized that the LFL is often slightly lower than the LEL.

Note 2 to entry: See IEC 60079-20-1.

[SOURCE: IEC 60079-2:2014, 3.24, modified – In the definition, the parentheses have been moved to a second note to entry, and the existing note has been replaced by a new note.]

### **3.8**

#### **opening**

inlet, outlet, door or non-airtight fixed panel

### **3.9**

#### **pressurization**

technique of guarding against the ingress of the external atmosphere into a room by maintaining clean air therein at a pressure above that of the external atmosphere

### **3.10**

#### **pressurization system**

grouping of safety devices and other components used to pressurize and monitor or control a pressurized room

### **3.11**

#### **restricted access door**

door with controlled or limited use or alarmed when open

### **3.12**

#### **safety device**

item used to implement or maintain the integrity of the type of protection

### **3.13**

#### **pressurized room**

room volume protected by pressurization and of sufficient size to permit the entry of a person who may occupy the room

### **3.14**

#### **artificially ventilated room**

room volume protected by artificial ventilation and of sufficient size to permit the entry of a person who may occupy the room

Note 1 to entry: The room volume can be an entire room (general) or part of a room (local ventilation).

**3.15****purging**

operation of passing a quantity of clean air through the room and ducts in a pressurized or artificially ventilated room, so that the concentration of the explosive gas atmosphere is brought to a safe level

**3.16****room volume**

<of the pressurized or artificially ventilated room> volume of the empty room and including any associated ducting without internal equipment

**3.17****pressurization "pb"**

pressurized room that provides an equipment protection level Gb or Db

**3.18****pressurization "pc"**

pressurized room that provides an equipment protection level Gc or Dc

**3.19****artificial ventilation "vc"**

artificial ventilation of a room with or without an internal source of release, such that the room provides an equipment protection level Gc

**3.20****artificial ventilation**

technique of guarding against an explosive atmosphere by the use of mechanical means to provide for the movement of air

**3.21****ventilation system**

complete installation required to produce artificial ventilation

**4 Requirements for all rooms****4.1 General**

Protection by pressurization and protection by artificial ventilation are separately described but may be combined to protect against hazards where required. Where both techniques are combined, then requirements for both shall apply. Unless otherwise identified in Clauses 6 or 7, the requirements in 4.2 to 4.10 apply to both protection techniques.

NOTE Annex C provides examples of applications and associated guidelines.

**4.2 Type and level of protection****4.2.1 Pressurization "p"**

Rooms with pressurization "p" and located in a hazardous area shall be one of the following:

- a) Level of protection "pb" (EPL Gb or Db). The pressurized room maintains an internal overpressure reducing the risk of ingress of an explosive atmosphere and is suitable for use in an area requiring EPL Gb or Db, permitting unprotected equipment to be installed within the pressurized room except for pressurization safety devices (see 6.3.1).
- b) Level of protection "pc" (EPL Gc or Dc). The pressurized room maintains an internal overpressure reducing the risk of the ingress of an explosive atmosphere and is suitable for use in an area requiring EPL Gc or Dc, permitting unprotected equipment to be installed within the pressurized room except for pressurization safety devices (see 6.3.1).



#### 4.2.2 Artificial ventilation "v"

The artificial ventilated room maintains artificial ventilation to dilute a release of flammable substance to reduce a hazardous area inside such that the required EPL is reduced from either Gb or Gc to non-hazardous or from Gb to Gc.

Rooms with artificial ventilation "v" and located in a hazardous area shall be:

- level of protection "vc" (EPL Gc). The ventilated room maintains artificial ventilation to dilute a release of flammable substance to reduce a hazardous area such that unprotected equipment can be installed within the artificially ventilated room, and is suitable for use in an area requiring EPL Gc.

NOTE This permits equipment with a lower EPL to be installed within the artificially ventilated room except for ventilation safety devices (see 7.3.1).

Rooms may be protected by either general or local artificial ventilation. General artificial ventilation applies to an entire room or significant portion of a room and local artificial ventilation applies to restricted regions, for example an extraction hood.

#### 4.3 Construction

The protected room shall, at a minimum, be designed to allow pressurization or artificial ventilation to be used in accordance with Clauses 6 or 7.

NOTE The room construction requirements could be affected by the location, occupancy requirements, and functionality.

For pressurized rooms and rooms protected by artificial ventilation, provision shall be made to ensure adequate purging of dead air spaces created within the room, for example by avoiding suspended ceilings, trenches, or raised floors.

#### 4.4 Mechanical strength

The room and any ducts and their connecting parts shall be designed to withstand the maximum pressure of the pressurization or ventilation system. This shall be verified by the design documentation or by the overpressure test of 6.4.2. National or regional building requirements may also apply.

Test for mechanical strength need not be carried out on the completed room but may instead be applied to all parts such as windows, gland plates, penetrations, doors, inlets or outlets of the room which are not made of steel or concrete but which are integral to the type of protection. In this case, the tests may be carried out on the parts themselves, appropriately mounted for the test.

#### 4.5 Penetrations and seals

The entry of cables, electrical conduits and other penetrations into the room shall be sealed so that the necessary pressure differential or artificial ventilation integrity is maintained.

Measures shall be taken to minimize the exchange of atmosphere between the inside and the outside of the room where this may lead to another hazard, for example displacement of vapours via floor drainage facilities.

Barriers may need to be considered for certain room designs to minimize ingress or egress of gases or vapours, for example this may include liquid seals such as s-bends in drain piping.

#### 4.6 Personnel access doors

Where protection against ingress of a flammable atmosphere is required, doors for personnel access shall be automatically self-closing, close fitting, and designed to close and latch

against the normal pressure differential. Restricted access doors are not required to be self-closing.

NOTE Refer to IEC 60079-10-1 for additional guidance on doors.

#### **4.7 Inlets and outlets**

For pressurization and general artificial ventilation, the location of air inlets and outlets shall be arranged to ensure even distribution of the clean air flow to minimize pockets where gases or vapours could accumulate, taking into account the density of those gases and vapours. Verification shall be according to 6.4.4 or 7.5.3.

Where it is not possible to avoid pockets where gases and vapours can accumulate, alternative methods of detection and control shall be used.

#### **4.8 Ducts**

In order to minimize the entry of contaminated air in the duct or loss of system performance, the fan suction and discharge ducts should be suitably designed to be free of leaks and protected against foreseeable mechanical damage.

NOTE Ducts for the pressurization system or ventilation system can be subject to applicable national or regional standards for building fire requirements.

#### **4.9 Purging and cleaning**

##### **4.9.1 General**

Purging of flammable gases or removal of combustible dusts from a pressurized room or an artificially ventilated room is required at both the initial commissioning of the room and following loss of pressurization or loss of flow, respectively.

Administrative procedures or other controls during loss of pressurization or artificial ventilation may be deemed by the user sufficient to ensure a gas free atmosphere under some conditions, for example during short time loss of pressurization or artificial ventilation and when no other abnormal situations are present. However, the means for purging shall still be provided.

##### **4.9.2 Gases – Purging**

###### **4.9.2.1 General**

Before energizing any electrical equipment which is not suitable for the EPL required in a pressurized room or an artificially ventilated room, it is necessary to ensure the concentration of flammable gas is not more than 25 % of the limiting value (see 3.6) by purging with clean air.

Purging shall be verified by either:

- a) flow measurement at the dedicated outlet to detect flow below the minimum purge rate determined for the system;
- b) detection of the room pressure above that determined for the pressure at the minimum purge rate in conjunction with
  - flow sensing at the dedicated outlet, or
  - gas detectors, where there is not a dedicated outlet, or flow detection is not practicable at the outlet, to confirm the purge has been effective and that the concentration of flammable gas within the room is at or below 25 % of the limiting value. Gas detection cannot be used as to reduce the initial purge requirement of 4.9.2.2 but may be used to extend the purge time where appropriate.

#### **4.9.2.2 Purge volume and flow rate**

The purge volume for pressurization and for general artificial ventilation shall be a minimum of 10 room volumes unless a reduced purge volume can be verified by 6.4.4 or 7.5.3 or determined from other analysis.

The purging flow rate shall be a minimum of five air changes per hour.

#### **4.9.3 Enclosures within the room**

During purging of the room, any enclosure which exceeds 5 % of the total internal volume of the room and that contains electrical equipment which is not suitable for the EPL required shall be

- a) vented to the exterior (if not an explosive atmosphere) or to the room so as to facilitate flow into and out of the enclosure, or
- b) individually purged, or
- c) individually pressurized to meet the required EPL.

For vented enclosures, top and bottom vents providing not less than 1 cm<sup>2</sup> of vent area for each 1 000 cm<sup>3</sup> with a minimum vent size of 6,3 mm diameter are commonly considered sufficient for adequate purging.

#### **4.10 Ignition prevention under system failure**

Upon failure of the pressurization system or ventilation system, appropriate measures shall be taken to prevent any ignition after power shut off from becoming active, for example hot surfaces above the ignition temperature.

NOTE This could be achieved either by the design and construction of the room or of the ventilation system, for example air locks or by providing sufficiently early shutdown to allow equipment to cool before the flammable concentration approaches the LFL. Other means such as bringing auxiliary pressurization systems into operation or other provisions could also be considered. See also Annex B.

### **5 Clean air supply**

#### **5.1 General**

Unless otherwise identified in Clauses 6 or 7, the requirements of Clause 5 apply to both types of protection (by pressurization and by artificial ventilation).

#### **5.2 Source of clean air**

The source of clean air shall be determined from the nature of the process and the physical layout and should be from a non-hazardous area. Under certain conditions as prescribed below and in 6.1.2 and in 7.1.2, the source may be from a Zone 2 area.

When the air intake is from a Zone 2 area, in addition to the pressurization or ventilation system requirements, the following apply:

- a) there shall be at least one flammable gas detector with alarm in the air intake; and
- b) there shall be at least one flammable gas detector with alarm within the room; and
- c) flammable gas detection in the air intake shall be arranged to shut down the intake of air containing flammable vapour or gas into the room on detection of 25 % of the limiting value; and
- d) flammable gas detection and all other electrical equipment used for alarming and emergency actions/interlocks and the supply fan and motor shall have an EPL suitable for the area without pressurization or ventilation system.